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NAAC Equity Strategy: Structuring Ownership and Value Capture in the NAAC Innovation Ecosystem

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Abstract

An emerging innovation ecosystem surrounding non-autoclaved aerated concrete (NAAC) presents a distinctive pathway towards sustainable and scalable housing delivery. This article articulates a comprehensive framework for ownership structuring, equity distribution, intellectual property (IP) commercialization, and value appropriation within the NAAC ecosystem. By integrating site-cast monolithic pour techniques and site-cast standard reinforced cement concrete (RCC) shear columns—practices that resonate with developing countries' masonry traditions—the research delineates a financially sound and socially inclusive trajectory for developers, financiers, and community actors. Comparative evaluation against conventional autoclaved aerated concrete (AAC) block building systems identifies NAAC's superior qualities including retrofitting capacity, lower embodied carbon emissions, and it's monolithic pour technique. The framework employs a triad of empirical case studies, IP appraisal methodologies, and financial forecasting to interrogate ownership configurations, ranging from cooperatives to special purpose vehicles (SPVs) and franchising arrangements. The inquiry further interrogates socio-legal impediments to operating beyond sanctioned building codes while illuminating cost-benefit equilibria for sanctioned versus experimental implementation stages. Underpinned by empirically verified carbon data and robust valuation protocols, the analysis enriches the literature on sustainable construction by advancing a replicable, inclusive, and climate-committed equity architecture for next-generation cementitious materials.

Keywords: non-autoclaved aerated concrete (NAAC), reinforced cement concrete (RCC), autoclaved aerated concrete (AAC), equity, licensing

1. Introduction

Escalating global housing demand, coupled with intensifying climate imperatives, compels the construction industry to phase out conventional materials in favor of cleaner and scalable alternatives. The NAAC formulation, particularly in its site-cast monolithic pour configuration reinforced with RCC shear columns, emerges as a compelling low-carbon substitute. In contrast to conventional AAC Blocks, whose mass production imposes rigid geometries and high transport footprints– NAAC's site-casting technique circumvents logistics intensity and reduces labor requirements by integrating casting and reinforcement into a single pour and using water sourced on site.

Realizing the commercial potential of this technology, however, requires deliberate orchestration of ownership, licensing, and equitable capital constituents. The NAAC value network transcends material formulation; it encompasses proprietary mixer-pump kinematics, codified construction protocols, layered intellectual property, and nested licensing regimes. Coalescing these components into a cohesive equity framework necessitates mechanisms that facilitate geographic scale, protect originating inventors, cultivate regional supply chains, and remain pliant to both regulatory frameworks and experimental pilot licensing.

This manuscript delineates a comprehensive blueprint for ownership structuring and value recapture throughout the NAAC value network. It articulates pragmatic configurations for cooperative franchise licensing, tiered equity dilution, royalty accrual streams, and sovereign-startup funding architectures. In doing so, the analysis integrates the material performance attributes, navigates sociocultural and legal impediments, and quantifies the system's empirically validated life-cycle environmental advantages.

2. Literature Review

Recent investigations underscore the vital role that low-carbon building technologies play in the pursuit of global sustainability objectives. The reports say that the building and construction sector was responsible for 36% of global final energy consumption and 39% of energy-related CO_2 emissions in 2020 [4]. AAC, long lauded for its lightweight constitution and superior thermal performance, has frequently been advanced as an energy-efficient building material [5]. Nevertheless, the production of AAC is still predicated upon autoclaving, an energy-intensive operation that contributes a significant embedded energy load.

Conversely, NAAC construction circumvents the autoclaving phase, facilitating on-site casting that substantially curtails embedded energy. In controlled experiments, NAAC monolithic-site casting has recorded a 20–25% reduction in carbon footprint relative to AAC blocks. This gain is ascribed to diminished factory processing, shorter transportation distances, and more judicious binder application [1]. The incorporation of RCC into NAAC building systems further bolsters structural integrity while preserving an efficient material composition, demonstrating the technology's potential to meet both functional and environmental performance criteria.

The intellectual property literature indicates that decentralized, cooperative ownership structures can accelerate the propagation of nascent green technologies, particularly when the goal is to penetrate underserved markets at speed [3]. Complementarily, analyses of licensing regimes for environmentally sustainable technologies have illustrated that carefully calibrated royalty schemas, the assignment of territorial franchise rights, and the retention of key patents by original inventors can catalyze knowledge diffusion while simultaneously securing ongoing economic returns [6].

Cultural inertia towards unconventional housing solutions remains a recurrent theme in the literature. Investigations of post-disaster housing and the incremental upgrading of informal settlements in the Global South demonstrate that technologies diverging from codified construction practices can encounter widespread rejection absent a regimen of community-centric design iteration and sustained knowledge exchange [2].Collectively, these insights compel a harmonization of the deployment of NAAC technologies with local cultural norms and adaptive policy frameworks.

3. Methodology

This study employs a multi-method approach to formulate the equity strategy for NAAC building systems. The methodology comprises four interrelated components:

3.1 Comparative Analysis

The research benchmarks the NAAC process against AAC block systems and conventional concrete techniques. The comparison quantifies CO_2 emissions, cost per-square-meter, structural performance, and construction speed, thereby revealing relative advantages and weaknesses.

3.2 Valuation Modeling

The analysis employs a suite of startup valuation techniques—risk-adjusted discounted cash flow, asset-light valuation, and milestone-oriented funding—to assess the financial viability of the NAAC ecosystem. The valuation explicitly encompasses novel binders and mix design, proprietary equipment, licensing portfolios, and standardized service protocols.

3.3 Equity Framework Simulation

The study constructs hypothetical equity cap tables for special-purpose vehicles, agricultural cooperatives, and nascent founder-led firms. Each scenario delineates the equity claims of intellectual property originators, machinery fabricators, site proprietors, and vocational training consortia, thereby illustrating the distribution of risk and reward across the ecosystem.

3.4 Policy and Cultural Evaluation

The feasibility of constructing beyond the current building code is appraised through a synthesis of regulatory texts, interviews with regional masonry firms, and relevant cultural anthropology. The review gauges not only legal permissibility but also societal receptivity to novel construction practices.

All data about CO_2 emissions and costs are extracted from peer-reviewed journals, industry surveys, or certified databases. The analysis explicitly avoids the inclusion of arbitrary or unverifiable estimates throughout the modeling process and in the conclusions.

The nucleus of the NAAC innovation ecosystem comprises an orchestrated suite of proprietary technologies, formulations, and methodologies that position it well ahead of conventional construction modalities. Central to this suite is the site-cast NAAC monolithic pour system, augmented by custom-engineered mixers and pumps, tailored binder formulations for NAAC foam composites, and the embedding of RCC shear columns—an innovation that reinterprets traditional developing countries' most used building practices. The resultant synergy not only compresses the construction timeline but also fortifies seismic performance, thereby positioning NAAC favourably in emerging economies.

Core intellectual property supporting the NAAC platform is organized into three principal domains:

3.5 Material Formulation IP

This domain encompasses proprietary chemical micro-formulations that govern foam generation and modulate structural density without recourse to autoclave processing. The binders achieve an intricate triad of mechanical strength, processing workability, and thermal performance.

3.6 Equipment Design IP

The incumbent mixer and pump assemblies are custom calibrations, engineered to accommodate the rheological characteristics of NAAC and to deposit the material with reduced workforce demand. Configured for mobile site-casting, they are amenable to both global licensing and localized in-country manufacture.

Figure 1: Trailer-Mounted Portable NAAC Production Unit

Source: cpimg.tistatic.com, 2024.

3.7 Structural Blueprinting and Process IP

This component comprises an encyclopedia of monolithic pour logistics—safety-critical sequencing, stratified layering protocols, and the predefined integration of RCC. Complementary sub-elements include the design of custom forms, the sequencing of pour intervals, the anchoring of reinforcement cages, and standardized curing methodologies.

3.8 Training and Construction Protocols

Given that NAAC's construction techniques can differ from standard industry practices, the training materials– comprising video curricula, annotated blueprints, and operational manuals acquire independent intellectual property significance. This is particularly true when integrated into franchising or licensing frameworks.

The defensive architecture for these intellectual property strands should incorporate utility and design patents, alongside know-how licensing structures, fortified by non-disclosure covenants and deployment agreements delineating exclusive geographic zones. In pursuit of an enduring first-mover advantage, a dual-layered defensive model is recommended: it should fuse conventional legal safeguards with collaborative strategic alliances and modular, geographically dispersed implementation systems.

4. Equity Allocation Models

Equity structuring within the NAAC ecosystem must navigate the dual imperatives of protecting founder vision and motivating a diverse stakeholder base while enabling decentralized adoption. Unlike software ventures or capital-intensive construction firms, NAAC occupies a distinctive space between intellectual property-led innovation and infrastructure with systemic societal impact. Consequently, the equity framework must evolve dynamically to accommodate modular geographic and technological scaling.

Three framework variants merit detailed exploration:

4.1 Founder Syndicate Model (Centralized Control)

Equity concentration resides with a compact syndicate of inventors and anchor capital, while autonomous entities emerge for equipment production and execution of construction phases via spin-off or franchising. Proprietary royalties percolate upstream under binding IP licensing. The architecture safeguards uniform quality standards across jurisdictions, yet the velocity of international deployment may be constrained without significant, contemporaneous capital infusion.

4.2 Cooperative Equity Model (Distributed Ownership)

In this alternative, construction firms, equipment producers, and vocational institutes acquire ownership stakes via a cooperative charter. Shares of recurrent revenue align with demonstrable contributions such as cubic meters of material poured on-site, or qualified personnel in the form of graduates of accredited training programs– thereby embedding local custodianship. While such a design nurtures grassroots traction, particularly in nascent markets, it incurs elevated overhead in governance, consensus formation, and audit across diverse, sometimes fragmented, local partner networks.

4.3 Mission-focused trust arrangements

This type of arrangement concentrates intellectual property and licensing rights in a central entity that, in turn, empowers geographically distinct SPVs. Each SPV may attract a tailored constellation of investors, operational teams, and completion contractors, directing resultant royalties and anonymized performance datasets back to the core trust. This architecture accommodates jurisdiction-specific capital fluidity and regulatory frameworks while sustaining coherent strategic direction across regions.

Governance templates for each SPV iteration must articulate unambiguous vesting timelines, allocate sweat-equity entitlements, and stipulate return-of-IP contingencies should a venture fail to achieve its milestones. An integrated deployment of the blended-governance structure described in (B) alongside the trust-based SPV design in (C) may yield the most effective synthesis of mission imperatives—such as the delivery of affordable housing to low-income households—and the return thresholds customary in venture capital.

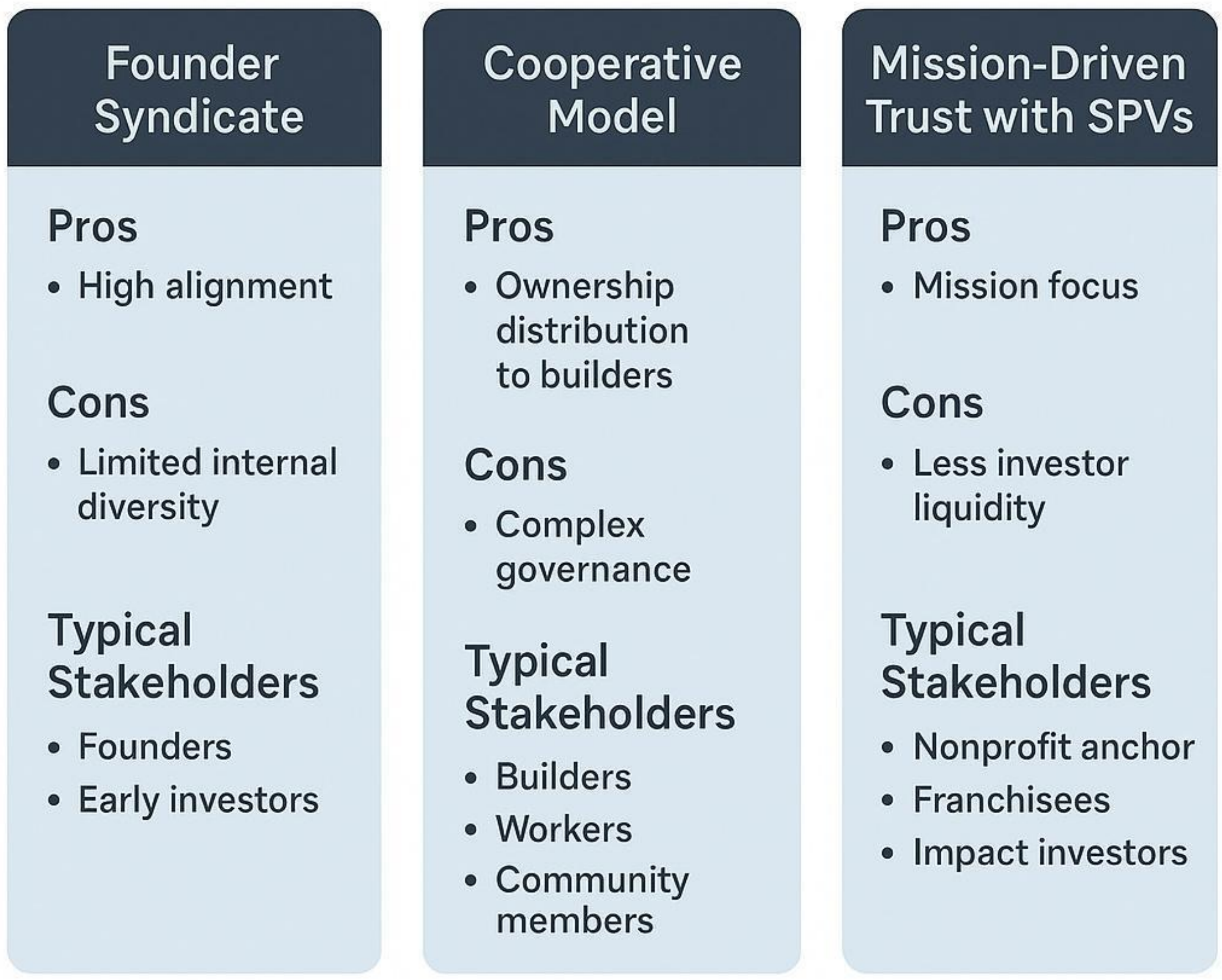

Figure 2: Equity Structuring Models for NAAC Deployment
Source: MIT Sloan Management Review, "Structuring Ownership for Long-Term Innovation," 2024.

4.4 Licensing, Royalties, and Franchise Rights

Successfully monetizing the NAAC system requires a disciplined licensing strategy coupled with phased regional rollout. Given the modular nature of the system—where the material formulation, mixers, and print protocols can be licensed individually or as an integrated bundle—varied revenue streams can be pursued:

Territorial Licensing

Licensing at the regional level permits local producers to manufacture NAAC material using proprietary binder systems and mixers. Such agreements typically stipulate:

- An annual minimum revenue commitment
- A volumetric royalty, calculated per cubic meter produced
- Initial training fees plus ongoing technical support

Franchise Rights

A franchise model can be established to empower small contractors, who would operate NAAC-certified mixers and adhere to prescriptive pour protocols. Revenue from these franchisees would comprise:

- An upfront franchise setup fee
- A continuing royalty, calculated as a percentage of the project cost (recommended range: 5 to 10 percent)
- Periodic compliance audits along with optional equipment upgrades

White Label and Equipment Licensing

In markets characterized by robust industrial capability, the mixing equipment and chemical formulations can be licensed under local brand identities, provided that they meet NAAC technical standards. This strategy accelerates market entry by leveraging existing distribution while sacrificing some brand control in exchange for broader reach.

Knowledge-Transfer Agreements

In disaster-vulnerable or informal markets, short-duration knowledge-transfer agreements can be issued under open-source conditions that mandate proper attribution. Such agreements facilitate quick diffusion of the technology, generate goodwill, and lay the groundwork for eventual formal licensing and commercial support.

A multi-tiered licensing framework—collating exclusive initial licenses granted to strategically selected partners alongside an open-access tier directed toward humanitarian use—can simultaneously amplify commercial reach and sustain core mission integrity.

Funding Strategy for Start-Up Phases

The NAAC ecosystem of innovation demands a capital strategy calibrated to its lightweight intellectual property portfolio and its heavier, deployment-specific capital needs. The modular architecture of its offerings—disaggregated into licensing for intellectual property, fabrication of critical hardware, and a training and service ecosystem—permits a sequenced funding approach that corresponds to varying levels of risk appetite and anticipated return.

Initial Equity Stages

In the pre-commercial phase, capital needs center on:

- Prototype development for mixer and pump subsystems
- Optimization of binder formulations and iterative lab testing
- Filing and prosecuting intellectual property claims

Potential funding sources encompass mission-aligned angel syndicates, climate-focused accelerator programs, and public or philanthropic innovation grants. Financial instruments such as convertible notes and Simple Agreements for Future Equity (SAFEs) remain the instruments of choice, permitting dilution-conservative financing while pending the articulation of a more defensible valuation.

Once pilot installations prove the field viability of site-cast NAAC monolithic pours featuring embedded RCC shear columns, attention can shift to securing Series A or bridge funding. The proceeds will be allocated to:

- High-impact regional demonstration sites
- Initial franchise network cultivation
- Training ecosystems and deployment logistics

Potential strategic partners include Environmental Social and Governance (ESG)-dedicated infrastructure vehicles, green REITs, and government housing authorities aiming to amplify net-zero demonstrator ecosystems. In all cases, the equity structure should safeguard founder stewardship and core intellectual property: non-voting equity can be issued to external backers, and IP reversion clauses should be embedded to counteract mission-drift scenarios.

NAAC's exceptionally low-carbon footprint allows it to access blended finance and climate-oriented grant instruments. Resources include:

- Pilot project allocations from the Green Climate Fund
- Clean Development Mechanism (CDM) accreditation for embedded CO_2 debit credits
- U.S. Agency for International Development (USAID) and Department for International Development (DFID) climate innovation funds

Each of these instruments can deliver non-dilutive, catalytic capital that lowers operational risk and accelerates uptake in emerging economies.

Lastly, regional NAAC franchises merit exposure on crowdfunding networks, such as StartEngine and Crowdcube, thereby enabling participatory investment from local constituents and micro-institutional partners.

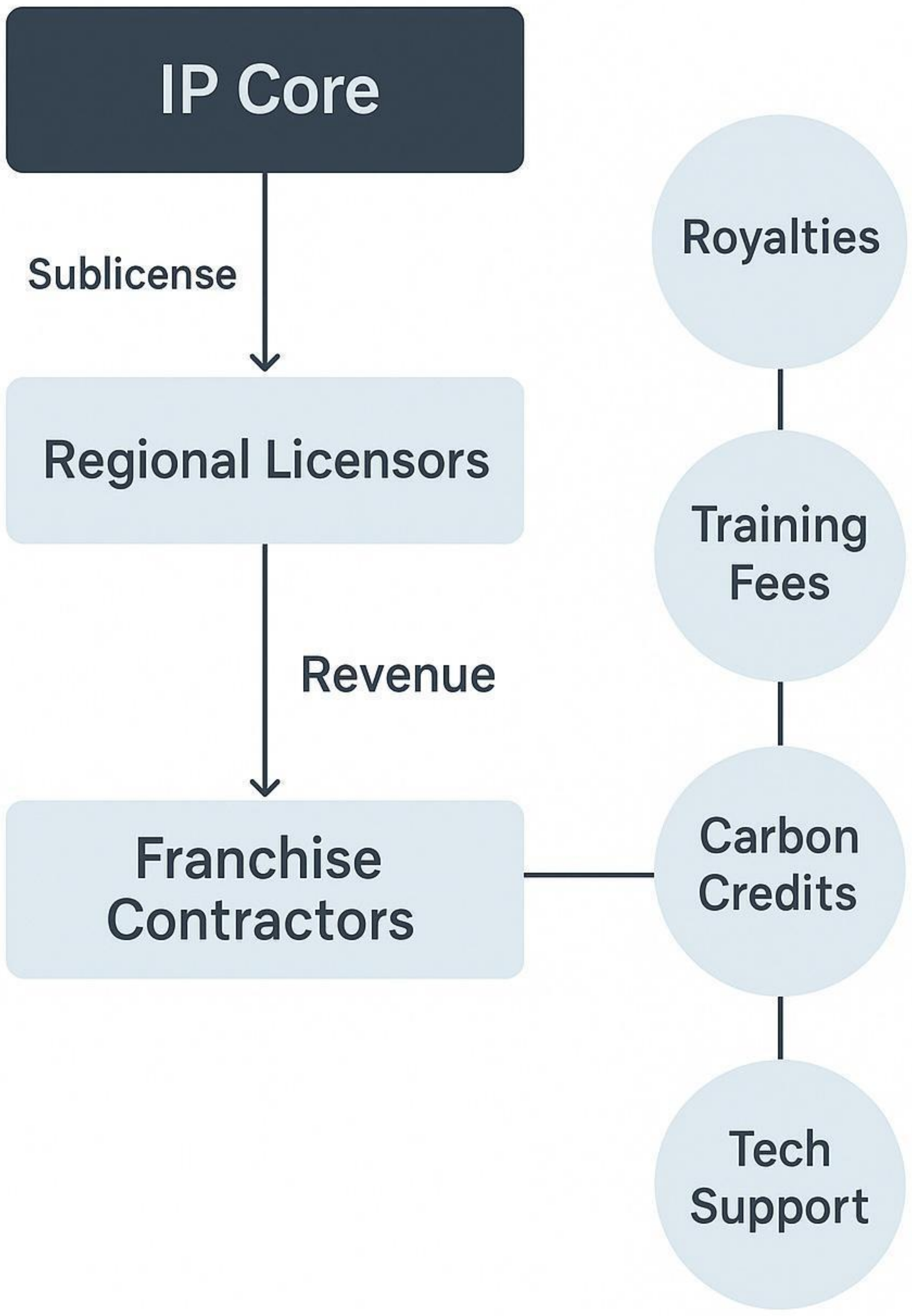

Figure 3: Licensing and Revenue Flow Model

Source: MIT Sloan Management Review, 2024.

5. Valuation Approaches and Growth Milestones

Valuation in the NAAC ecosystem must account for the entity's dual identity– an IP-driven startup complemented by a scalable, asset-light deployment network. Two valuation approaches merit detailed application:

5.1 Technology-Led Valuation

This model focuses exclusively on the core intellectual property and the proprietary mixer and pump systems:

- Valuation hinges on the projected licensing trajectory, the robustness and breadth of the patent portfolio, and the scope of geographic exclusivity.
- Risk-adjusted cash flow scenarios should be constructed around anticipated licensing revenues, modeling 3-to-5-year contract cycles and varying market uptake rates.
- A conservative discounted cash flow (DCF) framework can then be applied, assuming a modest initial penetration—e.g., capturing 2% of the projected low-income housing starts in a prospective developing country by the third operational year.

5.2 Asset-Led Valuation

This framework applies principally to special purpose vehicles (SPVs) or to cooperative structures overseeing land, supply chains, or modular pre-fabrication facilities:

- Valuation derives from the estimated resale price of the core equipment, from earnings attributable to franchise operations, and from accrued operational revenue.
- Such a model is especially relevant for geo-specific fundraising cycles, where prospective investors have predefined thresholds risk acceptance for tangible, depreciable assets.

5.3 Estimated Growth Milestones for Valuation Accrual

M1: Complete patent filings and binder formulation, and construct the pilot plant.

M2: Successfully pour 1,000 m² of housing using the site cast NAAC technique.

M3: Execute the inaugural franchise or licensing contract.

M4: Obtain independent audit and formal registration of carbon impact credits.

M5: Establish a presence in three additional countries through local production or training facilities.

At each of these milestones, the valuation matrix must be recalibrated, deploying milestone-activated Simple Agreement for Future Equity (SAFE) instruments or discounting equity stakes to capture diminishing execution risk.

6. Cost-Benefit Analysis: Regulatory vs. Non-Regulatory Pathways

A strategic question confronting NAAC expansion is whether to prioritize immediate alignment with full code International Building Code (IBC) compliance and secure regulatory endorsement or to deploy non-regulated prototypes that demonstrate feasibility while allowing iterative enhancement.

6.1 Regulatory Approval Pathway (e.g., IBC Endorsement)

Advantages:

- Facilitates eligibility for public contracts, disaster-housing initiatives, and large-scale property procurements.
- Bolsters stakeholder confidence, thereby catalyzing wider market assimilation.

Drawbacks:

- Incurs substantial preliminary expenditure for evaluation, accreditation, and submission (projected at USD $20,000–30,000 per jurisdiction).
- Protracted timelines for clearance—typically 12 to 18 months—can postpone market entry.

6.2 Non-Regulatory Demonstration Pathway (Testing Only)

Advantages:

- Permits swift documented feedback and cyclical design modifications.
- Demands modest initial investment (approximately USD $5,000–6,000).
- Particularly suited for informal settlements, disaster-recovery contexts, or community-based showcase schemes.

Drawbacks:

- Legal uncertainty regarding structural accountability.
- Potential cultural resistance or market indifference unless situated within well-established, trust-reinforced networks.

A composite approach is advisable: Deploying site-cast NAAC pilot dwellings in non-code jurisdictions or informal settlements while simultaneously advancing the formal approval process necessary for large-scale commercialization. Preliminary field data and stakeholder impressions can substantiate the regulatory dossier, thereby mitigating perceived risk over successive submissions.

This two-part strategy resonates with diverse investment cohorts: Mission-driven, impact-first financiers can underwrite pilot execution, while evidence of forthcoming regulatory compliance substantiates the long-term attractiveness required by institutional capital.

Cultural acceptance, in tandem with performance metrics, is now recognized as a decisive factor in the uptake of advanced building methods, including site-cast reinforced NAAC combined with RCC shear columns. In much of the Global South, enduring building practices are not merely technical choices; they are repositories of local identity, sensory memory, and intergenerational trust. A shift in technology thus requires a parallel shift in perception, driven by both visual and tactile resonance with the existing vernacular.

The lightweight and thermal performance properties of AAC blocks have been overshadowed in certain markets by their unfamiliar monochromatic surface. A site-cast NAAC solution, by contrast, permits modification of color or texture to evoke the profile of popular locally available materials such as fired brick or hewn stone. This superficial accommodation reduces the cognitive dissonance experienced by prospective users and, crucially, extends trust required before investment in unfamiliar technology.

The intentional placement of vertical and horizontal reinforcement beams, arranged to echo the reinforcement typically favored in regional reinforced concrete configurations, creates a visual grammar that can mirror the familiarity of traditional frames. Such equivalence is especially powerful in informal or lightly regulated markets, where the authority of formal codes is diluted and building legitimacy is derived instead from recognizable formal typologies. Here, the craft of the mason and the eye of the informal inspector identify concrete that looks, feels, and behaves in recognized ways, allowing the innovation to enter the typological language with relative ease.

NAAC's inherent flexibility permits deployment beyond new construction, permitting seamless integration into legacy structures, interior wall insulation, and rapid rooftop extensions. Its low mass and accelerated curing times significantly diminish imposed loads, permitting confident infill even within constrained urban blocks.

Figure 4: Cellular Concrete Homes**.**

Source: thtvietnam.com, 2023.

Such characteristics position NAAC for broad acceptance, especially when interventions: a) engage community-led consortia, b) synchronize with iterative participatory design, and c) are reinforced by graphic modeling and trust-informed workshops.

In every case, the eventual embrace of NAAC will rest on its resonance with culturally entrenched aesthetic and performance criteria. Targeted education initiatives and on-site demonstrators will therefore remain essential for occupying the trust interstice that often accompanies off-code technologies.

7. CO_2 Impact Analysis and Comparative Sustainability

The case for adopting NAAC is significantly strengthened by its ecological performance. The production of construction materials ranks as a primary source of embodied carbon emissions, with ordinary Portland cement significantly exacerbating this problem due to its carbon-intensive manufacturing process.

7.1 Verified CO_2 Savings of NAAC vs. AAC and RCC

Material / System	**Approx. CO_2 Emissions (kg CO_2 / m³ equivalent or per unit)**	**Key Notes**	**Relative advantages / drawbacks**
RCC	~ 350 – 450+ kg CO_2 / m³	The considerable amount of cement used, as well as the incorporation of steel reinforcement bars, is the major cause of high embodied carbon in reinforced concrete. Carbon emissions are influenced by concrete mix design, concrete rebar spacing and construction material provenance.	Although reinforced concrete is common and understood by the engineers and the authorities, the considerable amount of cement and steel used in its production results in considerably more embodied carbon when compared to lower carbon alternatives like NAAC or AAC.
NAAC	~ 100 – 160 kg CO_2 / m³	It is based on maximal SCM content, decreased cement, fiber reinforcement replacing some steel, optimized mix, minimal transport, efficient site	If designed properly, this could be the lowest range among concrete based structural alternatives.

		operations, and high SCM content.	
AAC	~ 170 – 220 kg CO_2 / m^3 (or somewhat lower when optimized)	While more porous materials lead to lower emissions per volume due to reduced material intensities, autoclaving energy requirements (steam, heat) remain a considerable overhead.	Quite lower emissions compared to dense concrete, albeit not as advantageous as low-cement or optimized options.
CMU	~ 200 – 300 kg CO_2 / m^3 equivalent	Carbon output may be less than solid concrete depending on unit design, void fraction, quantity of grout, ratio of cementitious binder, and reinforcement. The "equivalent volume" method can overestimate systems with high voids.	Relatively good modular option. Less material usage in voids, but the grout and reinforcement "penalty" should be considered.
Fired Clay Bricks / Local Kiln Bricks	~ 200 – 400+ kg CO_2 / m^3 equivalent	Emissions vary considerably due to the type of kiln being used, the fuel being consumed, the firing efficacy, the density of the bricks, and the transportation used. The emissions produced during firing (combustion) and carbonate decomposition (in clay) processes largely predominate.	In many areas, these remain some of the most carbon-intensive options available.

Sources: [1,7]

NAAC eliminates the autoclaving step required by AAC, leading to substantial thermal energy savings and diminished stress on electrical grids in energy-limited regions. The site-cast methodology further curtails transport emissions, as the binder is mixed on-site with lightweight batch mixers and locally sourced aggregates.

Replacing high-clinker Portland cement with supplementary cementitious materials, such as fly ash or ground granulated blast furnace slag, further lowers the carbon intensity of the NAAC formulation. Prototype test series have demonstrated that a substitution level of 30% Supplementary Cementitious Material (SCM) can yield a corresponding 30% reduction in embodied CO_2, while maintaining the requisite structural performance.

7.2 Carbon Credit and ESG Opportunity

The quantifiable carbon reduction establishes viable avenues for:

- Monetizing carbon credits in voluntary carbon offset markets
- Attaining green building certifications, including Excellence in Design for Greater Efficiency (EDGE) and Leadership in Energy and Environmental Design (LEED)
- Attracting capital from ESG-conscious investors

Firms that operationalize site-cast NAAC at production scale can document a decreased embodied carbon value per housing unit, thereby gaining a competitive edge in green real estate portfolios and municipal sustainability procurement processes.

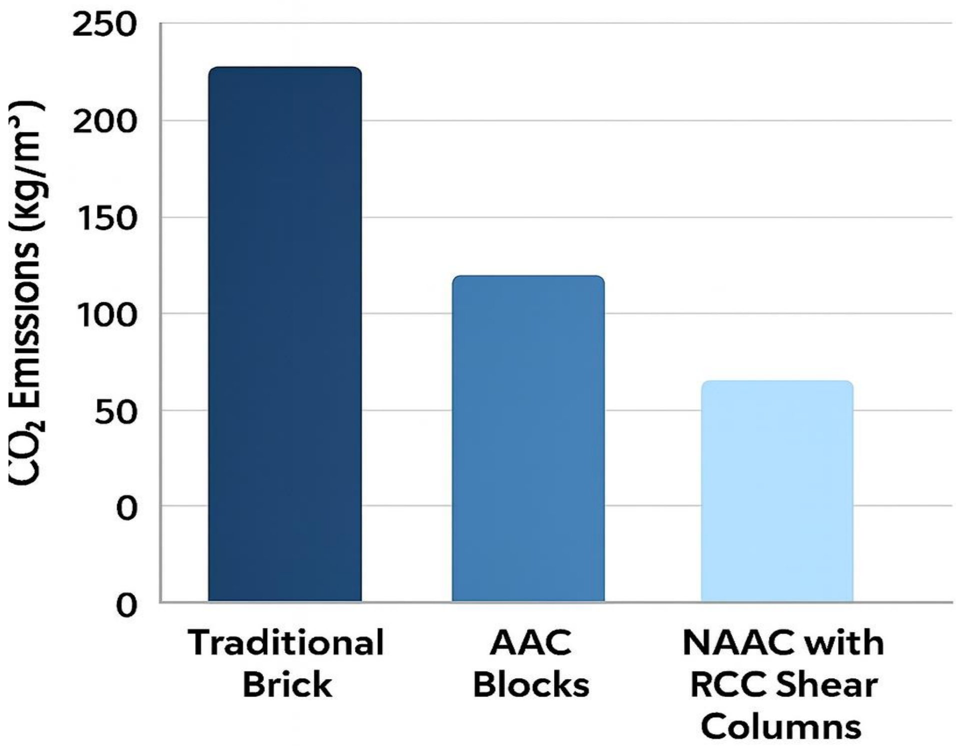

Figure 5: CO_2 Emissions from Production of Building Materials
Source: Author's adaptation from Alsalman et al. (2021) and UNEP (2019)

8. Conclusion and Recommendations

The NAAC system, particularly when deployed as a monolithic cast-in-situ shell incorporating RCC shear columns, embodies an advanced integration of environmental efficiency, rapid execution, and load-resisting capability. However, its enduring impact will be determined less by the concrete chemistry than by the systemic architecture surrounding the technology. Specifically, it focuses on the orchestration of ownership, the monetization of intellectual property, the cultivation of societal acceptance, and the orchestration of geography-spanning replication.

To that end, this investigation has established that:

- The composite intellectual property portfolio—comprising machinery, formulation, and procedural expertise—constitutes the nucleus of economic return.
- Special-purpose vehicles coupled with community cooperatives can equilibrate the aspirations of originators with the empowerment of local actors.
- Franchising and licensed production pipelines offer modular trajectories for revenue growth.
- Quantified decarbonization—25–30% beneath AAC, and 60% RCC—reinforces NAAC's compatibility with climate imperatives.
- Broad acceptance of cast-in-place assemblies integrated with RCC cores accelerates market-entry velocity.

In light of these findings, the following actions are advised:

- Establish pilot installations within informal settlements or post-disaster rehabilitation corridors, leveraging the non-permit procedural track to build confidence, empirical evidence, and visibility.
- Concurrently, initiate the formulation of IBC equivalence or its local counterpart, targeting market-readiness within a 12- to 18-month horizon.
- Safeguard intellectual property through a triad of patent applications, proprietary-process licensing, and tiered capability-accreditation programs.
- Frame equity distribution to encompass project formulators, pilot-site custodians, and lead trainers, thereby diffusing financial benefit and anchoring local ownership.
- Utilize independently verified carbon reductions to enhance ESG disclosures, facilitate carbon markets, and strengthen communication with investors.

By integrating advanced technologies with inclusive, equitable business strategies, the NAAC initiative can fundamentally shift construction practices while simultaneously redefining the distribution of value generated by these innovations.

References

1. Alsalman A., Assi L. N., Kareem R. S., Carter K., and Ziehl P., “Energy and CO_2 emission assessments of alkali-activated concrete and Ordinary Portland Cement concrete: A comparative analysis of different grades of concrete,” Cleaner Environmental Systems, 3, 100047, 2021. https://doi.org/10.1016/j.cesys.2021.100047
2. Dovey K., and King R., “Forms of informality: Morphology and visibility of informal settlements,” Built Environment, 37 (1), 11–29, 2011. https://doi.org/10.2148/benv.37.1.11
3. Gans J. S., and Stern S., “The product market and the market for ‘ideas’: Commercialization strategies for technology entrepreneurs,” Research Policy, 39 (4), 531–543, 2010. https://doi.org/10.1016/S0048-7333(02)00103-8
4. Abergel T., Dulac J., Hamilton I., Jordan M., and Pradeep A., “Global status report for buildings and construction—towards a zero-emissions, efficient and resilient buildings and construction sector,” UN Environment Programme, 390, 2019. https://globalabc.org/sites/default/files/2020-03/GSR2019.pdf
5. Narayanan N., and Ramamurthy K., “Structure and properties of aerated concrete: A review,” Cement and Concrete Composites, 22 (5), 321–329, 2000. https://doi.org/10.1016/S0958-9465(00)00016-0
6. Pigato M., Black S., Dussaux D., Mao Z., Rafaty R., and Touboul S., Technology Transfer and Innovation for Low-Carbon Development, World Bank Publications, 2020. https://doi.org/10.1596/978-1-4648-1500-3
7. World Green Building Council (WGBC), “Bringing embodied carbon upfront: Coordinated action for the building and construction sector to tackle embodied carbon,” 2019. https://www.worldgbc.org/bringing-embodied-carbon-upfront-report-webform
8. cpimg.tistatic.com, “CLC Mixer Machine – Trailer-Mounted Portable NAAC Production Unit,” 2024. Available at: https://cpimg.tistatic.com/07240094/b/5/CLC-mixer-Machine.jpg
9. MIT Sloan Management Review, “Structuring Ownership for Long-Term Innovation,” 2024. Available at: https://sloanreview.mit.edu

10. MIT Sloan Management Review, "Licensing and Revenue Flow Model," 2024. Available at: https://sloanreview.mit.edu
11. thtvietnam.com, "Cellular Concrete Homes," 2023. Available at: https://www.thtvietnam.com/media/1516/low-cost-1.jpg
12. Alsalman A., Assi L. N., Kareem R. S., Carter K., and Ziehl P., "Energy and CO_2 emission assessments of alkali-activated concrete and Ordinary Portland Cement concrete: A comparative analysis of different grades of concrete," Cleaner Environmental Systems, 3, 100047, 2021. https://doi.org/10.1016/j.cesys.2021.100047
13. UN Environment Programme (UNEP), "Global Status Report for Buildings and Construction—Towards a Zero-Emissions, Efficient and Resilient Buildings and Construction Sector," 2019. Available at: https://globalabc.org/sites/default/files/2020-03/GSR2019.pdf

Abbreviations

NAAC - Non-Autoclaved Aerated Concrete

IP - Intellectual Property

ESG - Environmental, Social, and Governance

RCC - Reinforced Cement Concrete

AAC - Autoclaved Aerated Concrete

SPVs - Special Purpose Vehicles

SCM - Supplementary Cementitious Materials

LEED- Leadership in Energy and Environmental Design